Experts and resource users split over solutions to peatland fires

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Abstract

We provide empirical evidence that supports a commonly-held assumption: that experts' appraisals of policy options are often very distinct from those of resource users most affected by those policy choices. We collected data from 219 respondents about their perspectives of 40 policy options to address peatland fires in Indonesia, using a Q methodology approach to rank the options according to perceived effectiveness. Peatland fires in Indonesia are a long-standing and complex social-environmental challenge, where unsolved disagreements about policy options have profound implications for environmental governance, resulting in fires recurring and causing significant CO_2 emissions and transboundary haze that affects the health of millions. Our sample covered twelve stakeholder categories, including small and large landholders, industrial farmers, scientists, local leaders and government officials. We identified the most representative response from each stakeholder category, and used hierarchical cluster analysis to explore the closeness/distance in perspectives among categories. The results show a particularly noticeable distinction between two broad groups, which we labelled as experts and resource users. Experts tend to prefer solutions that are centralised and largely transformative, whereas resource users favour more localised measures that are more compatible with business-as-usual. We discuss possible reasons for these differences, and their implications for environmental governance, including for how scientists engage in policy.

Keywords

Perspectives; governance; policy; Indonesia; wildfires; Southeast Asia; Q methodology; perceptions

Highlights

- A perspective-mapping exercise about policy options reveals the magnitude of the split in experts and resource users' views.
- The two views distinguish centralised, transformative policy options, versus more localised and business-as-usual responses.
- Overcoming this split requires institutions and actors that can speak across the divide.
- To speak across the divide researchers can identify and empathise with diverse stakeholder views, acknowledging their own.

1. Introduction

Policy responses to major sustainability issues—such as catastrophic tropical wildfires, marine conservation, public health crises and ecosystem restoration—are often hampered by lack of stakeholder consensus over what policies to pursue (e.g., Adams et al., 2004, Costanza, 2000). Although disagreement among stakeholders is expected, derived conflicts can present huge challenges for environmental governance. This is particularly true for tensions in frontier landscapes and over scarce resources, situations where resource management approaches often contrast, and the issues are framed in very different ways. In these common situations, resulting policy choices can prove inadequate or counterproductive, risky, costly or inequitable (e.g., Ockwell 2018, Pascual et al., 2014).

For example, Indonesia's recurrent, catastrophic peatland fires—a long-standing intractable problem—cause significant CO_2 emissions and transboundary haze affecting the health of millions, among other issues. These fires are characterised by rapidly changing land-use patterns, newly-arrived human populations and complex patronage politics associated with land acquisition, farming and liability (Varkkey, 2013). They have yielded decades of intense policy and public debates over fire attribution and responsibility (e.g., Cattau et al., 2016, Forsyth, 2014, Gaveau et al., 2017, Tacconi, 2016) and over peatland management strategies, and generated a multitude of policy responses (Jefferson et al., 2020, Kopplitz et al., 2016, Marlier et al, 2015, Tan-Soo et al., 2019). Indeed, even 40 years since peatland fires became a leading environmental governance issue in Indonesia, there is still very little consensus among stakeholders about what policy solutions might be most effective at reducing fires, and fire governance is emblematic of broader tensions between environment and development in the region (Carmenta et al. 2017).

To better understand these tensions, we explored the perceptions of experts and resource users about fire policies. We use the term experts to refer to people with professionalised technical expertise and formal authority. Such actors often understand policy problems and solutions very differently to the resource users that they most directly affect (e.g., Jiren et al., 2018). We refer to these understandings as "different perspectives". In many cases, formal decision-making is informed by experts' technical knowledge, opinions and messages. Experts, as defined here, include technocrats, scientific advisors, researchers, specialist journalists and advocates who communicate technical advice—groups that also tend to share professional and information networks (e.g., Moeliono et al., 2014). We acknowledge that expertise goes beyond these types of stakeholders and that formal scientific expertise is increasingly disputed, with more inclusive models of knowledge production exposing its often apolitical characterisation and challenging the expert–citizen divide (Edelenbos et al., 2011, Fischer et al., 2000). Nevertheless, formal experts often play prominent (even outsized) roles in shaping, promoting and implementing many policies that influence sustainability outcomes across contexts. As researchers ourselves (part of the 'experts' group defined here), we have a growing responsibility to understand how our perspectives may differ from the views of other stakeholders, and how science and ensuing policy advice are understood by the broader public (cf. Muradian and Pascual, 2020), (re)interpreted by the media, and taken up by policy makers (Stevens, 2011). We distinguish experts from resource users, who are involved in a wide range of site and farm-level decisions that affect and are affected by fire, including local farmers (e.g. small scale farmers and industrial agricultural companies), labourers hired to work on plantations, and local residents not involved in farming (e.g. fishers).

Most research exploring differences in the perspectives of experts and resource users is largely qualitative (e.g., Jiren et al., 2018, Verran, 2002). Limited structured, quantitative

research compares directly expert and resource-user perspectives using the same instruments and prompts (e.g. applying Q methodology or opinion surveys) to resolutely identify specific points and the magnitude of disagreements. Quantitative approaches, despite their clear limitations (see Bennet, 2016), can be more legible and legitimate to decision-makers (Adams and Sandbrook, 2013) and corroborate findings between multiple types of evidence (Game, 2018).

While many previous studies have sampled policymakers, scientists, government officials and practitioners using methods to elicit perspectives such as Q methodology or Delphi, most focus on single or few stakeholder categories and hardly any explicitly compare perspectives across categories. Where they have, views were often analysed for areas of convergence (e.g., Toumbourou, 2018) or characterised into broader discourses (e.g., anthropocentric vs. ecocentric views, Sandbrook et al., 2019), rather than focused on specific policy choices. Moreover, few studies use the same set of questions with multiple stakeholder categories (although see Carmenta et al., 2017, Ray 2011).

In this study we quantitatively compare different stakeholders' perspectives about competing policy options to mitigate peatland fires in Indonesia. The goal is to identify whether there are similarities between specific stakeholders or clusters, which can facilitate understanding and navigation of controversial debates over environmental governance more constructively. This perspective-mapping exercise reveals a distinction between formal experts (e.g., government advisors, scientists, technical journalists) and those involved in using land resources more directly (e.g., land owners, farmers or agricultural industry). We draw on a uniquely large and diverse dataset of perspectives, elicited using Q methodology data from 219 individuals concerning 40 different policy options to address recurrent peatland fires in Indonesia. The study provides empirical evidence that supports a commonly-held assumption: that experts'

appraisals are often distinct from those of resource users. It unpacks their specific points of disagreement and elaborates on what might trigger such differences and what researchers can do about it.

Why we disagree and why it matters

Differences in perspective among stakeholder categories are partially explained by their distinct goals, understandings (e.g., of benefit and burden share), familiarity, and/or ontologies of the problem at hand (e.g., Adams et al., 2004, Levesque et al., 2019). They can also be caused by information asymmetries frequent in public policy arenas, by conflicts between public and private (individual material) interests (Jensen and Meckling, 1976), and by the contextual factors that shape individuals' capabilities to access information and represent their interests. Differences in perspectives (and failures to process these) are further aggravated by phenomena such as echo-chambers (Jasny et al., 2015) and confirmation biases (Masnic and Zimmerman, 2009), scepticism about experts and post-truth phenomena (Muradian and Pascual, 2020).

These disagreements have profound implications for how policy choices are understood, evaluated and pursued in environmental governance (Adams et al., 2003). Dissonant priorities can lead stakeholders to directly ignore or under-value each other's expertise (e.g., Visser et al., 2007). Importantly, negative outcomes from such disagreements are exacerbated by a range of power asymmetries. For example, in "principal-agent" problems, decision makers act on behalf of the many (e.g. their constituents), but follow the priorities of the few (e.g. those with vested interests, lobbies) that can be at odds or damaging to the latter (Barr and Sayer, 2012). Policy choices often follow powerful vested interests, contributing to the private accumulation of land and resources, while discounting under-represented views and blocking socially-beneficial policy options (e.g. Babon et al., 2014, Dell'Angelo et al., 2017).

The implications are particularly salient where disempowered stakeholders are further marginalized through policy choices that overlook their perspectives and circumvent their needs (Zafra-Calvo et al., 2020). These types of dynamics are intrinsic to Indonesian agricultural, land and fire policies (e.g., Prabowo et al. 2017, Wibowo and Giessen 2015).

We appreciate that disagreement and debate are important in environmental governance and that consensus is not a precondition for sound policy. Yet, disagreements combined with power asymmetries at the policy design stage may result in imposing the view of the actor with most hierarchical power, or manipulating discourses where one actor's framing power is superior (see Morrison et al., 2017). Significant misalignments between key actors can stall action, limit uptake if they affect acceptability, or even cause unintended feedbacks such as conflict, unrest and sabotage (cf. Dennis et al., 2005, Pascual et al., 2014, Scott 1985). They can also provoke rebound effects, for example, where prohibitions lead to riskier practices and aggravate negative outcomes (e.g., Carmenta et al., 2019). In contexts of high power asymmetries, participation, deliberation and identifying the distinct views among stakeholders, become ever more necessary for social equity, because some policy outcomes can affect disproportionately more vulnerable sectors of society (e.g. if the active or passive costs of implementation are borne by lower income communities).

Perspectives about Indonesian peatland fires

Extensive, uncontrolled peatland fires consumed landscapes in Indonesia and hit the international news in 2015, 2018 and 2019 (BBC 2019, Huijen et al., 2016, Miettinen et al., 2017). Fires are linked to rapidly expanded oil palm agriculture on peatland soils, which are drained to make farmland arable (land previously considered marginal), but also increasing their flammability. In 2015, a combination of drought, land clearance and peatland drainage resulted in fires that released 11.3 million tons CO_2 per day over two months. For

comparison, over the same period the European Union released 8.9 million tons (Hujnen et al., 2016). The resulting toxic smoke (haze) affected tens of millions of people, including beyond national boundaries.

As mentioned, these impacts have prompted widespread conflict among stakeholders, and there is little consensus over what solutions to implement (Carmenta et al., 2017). Large-scale wildfires across contexts are particularly appropriate to evaluate stakeholder perspectives, because they have often spurred protracted debates about the most adequate interventions (e.g., Boadle and Stargardter, 2019, Thung et al., 2018, Wijedasa et al., 2017). Previous work has explored narratives about fire use, focusing on differences between land users and experts elsewhere (e.g., Brazil, Carmenta et al., 2013, Ethiopia, Jiren et al., 2017, Australia, Verran, 2002). However, little contemporary research has elicited views by making explicit, quantified comparisons between experts and other stakeholders and in the context of Indonesian peatland fires. Such comparisons are greatly needed amidst growing public debate about the roles of experts in decision-making, democracy and populist politics, particularly in response to contemporary environmental catastrophes such as tropical wildfires (Bertsou and Caramani 2020, Fischer et al., 2000).

2. Methods

To capture the wide range of perspectives about policy options related to peatland fires, we collected data based on Q methodology (e.g. Barry and Proops, 1999). Q is a methodology to understand the diversity of opinions within a group, with two main features. First, data are collected using a specific questionnaire format, whereby respondents rank a set of statements. Second, the data are analysed using multivariate data reduction techniques, but focusing on correlations among responses, rather than among variables. This approach is suitable to

identify highly-diverse opinions, also those beyond the average or most represented opinions (as identified in standard surveys).

To collect Q data, respondents are given a set of items to rank (e.g. statements). The items are meant to prompt a subjective reaction or preference, for example, matters of opinion or trade-offs between alternatives. The items are printed on cards and the deck of cards is given to respondents, who place each card over a board according to their degree of agreement or along another pertinent scale. The board has a grid shaped as a quasi-normal distribution (see the grid used for this study in Fig. A1 in the Annex). The forced shape of the distribution allows researchers to elicit, for each response, the few items that trigger strongest positive and negative engagement, as well as a person's complex view, represented by the constellation of ranked items. Based on a respondent's full ranking (called a Q-sort) each item receives a score that enables quantitative analysis (See Fig A1).

Results obtained through Q are conceptually similar to those obtained with discourse analysis (i.e. a set of shared discourses or perspectives, Barry and Proops, 1999). The analysis in Q however, allows researchers to measure differences between discourses in a quantitative manner. To do so, the dataset is analysed using factor or principal component analysis, resulting in a few perspectives (Zabala et al., 2018). Perspectives represent the views of respondents who answered in similar ways, and are richly described based on the relative position of items and of the items ranked most distinctively (e.g. where one perspective strongly agrees with an item, whereas another one disagrees with it).

We selected a set of 40 policy options that could address peatland fires in Indonesia (listed in Table 1). We selected options based on peer-reviewed and grey literature, consultation with key informants and interviews (see further details in Annex). The options span diverse categories, including fire-prevention and fire-fighting measures (such as improving fire-

prediction tools), economic incentives (like supporting small-holders to clear land without using fire), awareness-raising (e.g. about the negative impacts of fire) or regulatory measures, and measures that are based on business-as-usual in contrast to transformational measures (such as forbidding agricultural expansion).

[Table 1 here]

Table 1. Policy options. Fire: P, fire prevention; F, fire-fighting intervention.

ID	Policy option	Type of intervention	Fire
S01	Improve the transparency and public participation in local planning processes	Governance	P
S02	Forbid fishing and hunting	Restriction	P
S03	Support communities to create their own local-level rules and sanctions about fire	Governance	P
S04	Increase enforcement against elite *desa* who allow use of fire	Enforcement	F
S05	Give incentives, such as rewards of money, seedlings, health and school services, for individual land holders to encourage them to prevent fire	Incentives	P
S06	Allow for the regulated, careful use of fire, such avoiding fire use during very dry and windy periods	Legalization	F
S07	Strengthen political agreements with neighbouring countries related to reducing fire and haze	Public pressure	P
S08	Conduct more research to improve knowledge about peatland and fire management	Technological	P
S09	Increase enforcement against independent investors (not companies) from outside Riau who allow fire on their land	Enforcement	F
S10	Strengthen companies' environmental standards to ensure they do not use, promote or facilitate fire	Voluntary PS	P
S11	Strengthen government-led fire fighting	Firefighting	F
S12	Build awareness about the various negative impacts of fire	Awareness	P
S13	RSPO (Roundtable on Sustainable Palm Oil) sanction members that use fire	Voluntary PS	F
S14	Strengthen anti-corruption efforts against people that use corruption to illegally gain land in Riau	Governance	P
S15	Plant land soon after it is cleared, instead of leaving it idle, because that will make it less vulnerable to fire	Agr. practice	P
S16	Increase use of shallow canals as fire breaks	Agr. practice	F
S17	National government should facilitate the process for transferring forest land into land for development (APL), so that people don't have to use fire as an excuse to gain this permission	Governance	P
S18	Increase central government control over land use and fire issues within Riau	Governance	P
S19	Large companies provide support to out-grower groups (plasma) to clear land without using fire	Agr. practice	P

S20	Mobilize civil society / NGOs to take actions to address fire	Public pressure	P
S21	Increase enforcement against large companies that allow fire	Enforcement	F
S22	Government provide support to small-holders to clear land without using fire	Incentives	P
S23	Increase enforcement against small-holder farmers that use fire	Enforcement	F
S24	Government cancel the licenses of companies that illegally use fire	Enforcement	F
S25	Give incentives, such as rewards of money and technical support, to local Riau government to encourage them to prevent fire	Incentives	P
S26	Strengthen company-based fire fighting	Firefighting	F
S27	Increase enforcement against paid labourers that use fire to clear land for other people	Enforcement	F
S28	Build awareness that burning to clear land is illegal	Awareness	P
S29	Re-flood drained peatlands	Agr. practice	P
S30	Increase use of traditional farming techniques and crops such as sago and coconut that are less vulnerable to fire than oil palm farming	Agr. practice	P
S31	Strengthen banks' standards to ensure they do not provide services or loans to people or companies who use fire	Voluntary PS	P
S32	Improve use of drone, plane and satellite-based technologies for fire detection	Technological	F
S33	Improve fire prediction tools	Technological	Both
S34	Reduce migration into Riau from other provinces	Restriction	P
S35	Build and staff more fire watch towers	Technological	F
S36	Improve peat land map quality to improve its management and fire prevention	Technological	P
S37	Build awareness to stop accidental fires from cooking or cigarettes butts	Awareness	P
S38	Strengthen local-level (e.g., MPA community-level) fire fighting	Firefighting	F
S39	Forbid new agricultural expansion into forested areas on peatland	Restriction	P
S40	Increase clarity on land tenure boundaries to avoid people using fire to grab land	Governance	P

The political significance of these options in terms of the attention they have received in public debates is also varied. We have included this diversity of options as representative of a broad spectrum of public discourses, to allow respondents themselves express which ones are salient in their own opinions. From these options, thus far governments have implemented mainly regulatory approaches, whereas the industry and civil society favoured incentives and technical interventions respectively (Jefferson et al. 2020).

We asked 219 people to rank the 40 policy options based on their perceived effectiveness at reducing peatland fires. While we asked respondents to focus on effectiveness, we are aware

that respondents might (implicitly or explicitly) also be expressing their choices based on preferences, feasibility or other considerations. We did not, however, explicitly ask about preferences in order to reduce sensitivity and due to concerns about social desirability. Inevitably this will have introduced some bias in our data, but reflects the multiple criteria people use in appraising policy options, and we considered this potential bias in interpreting the results.

We purposively sampled respondents affected by peatland fire issues from a wide range of backgrounds and included local (i.e. Riau-based), national (Jakarta-based) and international (Singapore-based) actors. Riau Province (Sumatra), epitomises the combination of rapid land-use change, extensive fires and a diversity of stakeholders of other landscapes in the region. Respondents were selected to reflect a wide range of private interests in peatland agriculture and vastly different types and levels of influence and importance over shaping fire policy and land-use decisions. They were classified into twelve stakeholder categories based on their main employment (hereafter *categories*, see Table 2).

[Table 2 here]

Table 2. Stakeholder categories included in the sample.

Code	Explanation	Definition	Number of respondents
LPF	Local leaders	Local leaders (village and district, most of whom are also involved in farming)	15
FL	Farm labourers	Workers that do not own land, but participate in industrial and non-industrial farming	15
SLH	Small landholders	Very small land holders that work their own land and usually live in the vicinity of their farms. This is likely to include indigenous people. (~2–4 ha)	42
MLH	Medium landholders	People who actively farm their own land (with or without hired labour) (4–10 ha)	34
LLH	Large landholders	People with expertise in agriculture and are actively involved in site management, but are not working their own land. Often established as a company, but not always. (>10ha)	15
IA	Industrial agricultural companies	Formally-recognised, government-granted large concessions	30
MAH	Mid-level absentee landholders	Non-companies, independent investors, often non-specialists and who purchase land via brokers (often in 2ha blocks), and are not actively	15

		farming their own land.	
LF	Landless fishers	Fishing communities who live within agricultural areas, but do not own land (often disenfranchised) and are not employed as farm labour. They are affected by fires and related policies.	15
RE	Riau-based experts	Technical staff at government and research institutions based in Riau	11
JE	Jakarta-based experts	Researchers at government and policy think-tanks working at a national level, based in Jakarta	9
SE	Singapore-based experts	Researchers/technical advisors at government and policy think-tanks working from a Singapore perspective	8
NGO	Civil society in Riau, Jakarta and Singapore	Officers of non-government organisations	10

Categories included resource users, local-level actors in Riau Province with direct professional, and often personal links to the agricultural sector. For example, landholders who work their own land and are situated along a gradient of the amount of land owned: small (<2–4 ha), medium (4–10 ha) and large (>10 ha) landholders, and industrial agricultural companies (holders of agricultural concessions). We included land users who do not own land (farm labourers, landless fishers), and landowners who themselves do not use the land (absentee landholders). We included local villages and district leaders, many of whom also own land. The sample also included researchers from international organisations and universities (e.g. CIFOR, ICRAF, World Bank, ASEAN), journalists reporting on technical aspects of fire management (e.g. Kompas, Jakarta Post), NGOs (e.g., Zoological Society of London, Karlo Sawit Watch, Greenpeace, Singapore Institute of International Affairs), and experts within government institutions responsible for informing national and provincial decision-making (e.g. Singaporean Environmental Agency, Singapore National Parks, Ministry of Environment and Forestry). Data were collected between July-September 2015 (see more details in Annex and in Carmenta et al., 2017).

Results from Q analysis are analysed to distinguish perspectives, but do not routinely differentiate those perspectives according to respondents' individual characteristics (e.g., gender, occupation). Reasons include that default Q analysis pools all respondents together in order to extract shared views, and that the respondent sampling procedure is usually

purposive, so samples tend to be small, hence precluding conclusions about representativeness of stakeholder categories. In this study, the large number of respondents provides additional leverage to explore perspectives by stakeholder categories.

First, we estimated the representative response for each stakeholder category (within our sample) by calculating the mean response within each category. This is a statistically simple and parsimonious approach, compared to others found in the literature and unique among Q studies (See Supplementary Methods in Appendix). Second, we conducted a hierarchical cluster analysis to explore affinities among stakeholder categories (i.e. similarity in the perspective held by each category). Finally, to understand how the resulting clusters thought differently about fire responses, we compared the full perspectives of both clusters To do so, we calculated the mean response for each of the 40 policy options by all the stakeholder categories aggregated within each cluster, and visualised them in a z-score plot for Q data (R Core Team, 2020, Zabala, 2014).

3. Results

Remarkably, the hierarchical cluster analysis revealed a surprising clear-cut split among the twelve stakeholder categories. They formed two clear groups (i.e. clusters of categories) holding distinct perspectives about policy options, and the categories within each group held relatively homogeneous perspectives. The cluster dendrogram (Fig 1) shows which specific categories within the overall dichotomy have closest views and which ones are more distinctive. Lower connections indicate more similar views, and the height where the connections are made indicates the strength of the similarity between categories (the lower, the higher the similarity). For example, the two closest perspectives were respondents in the medium and small land holder categories.

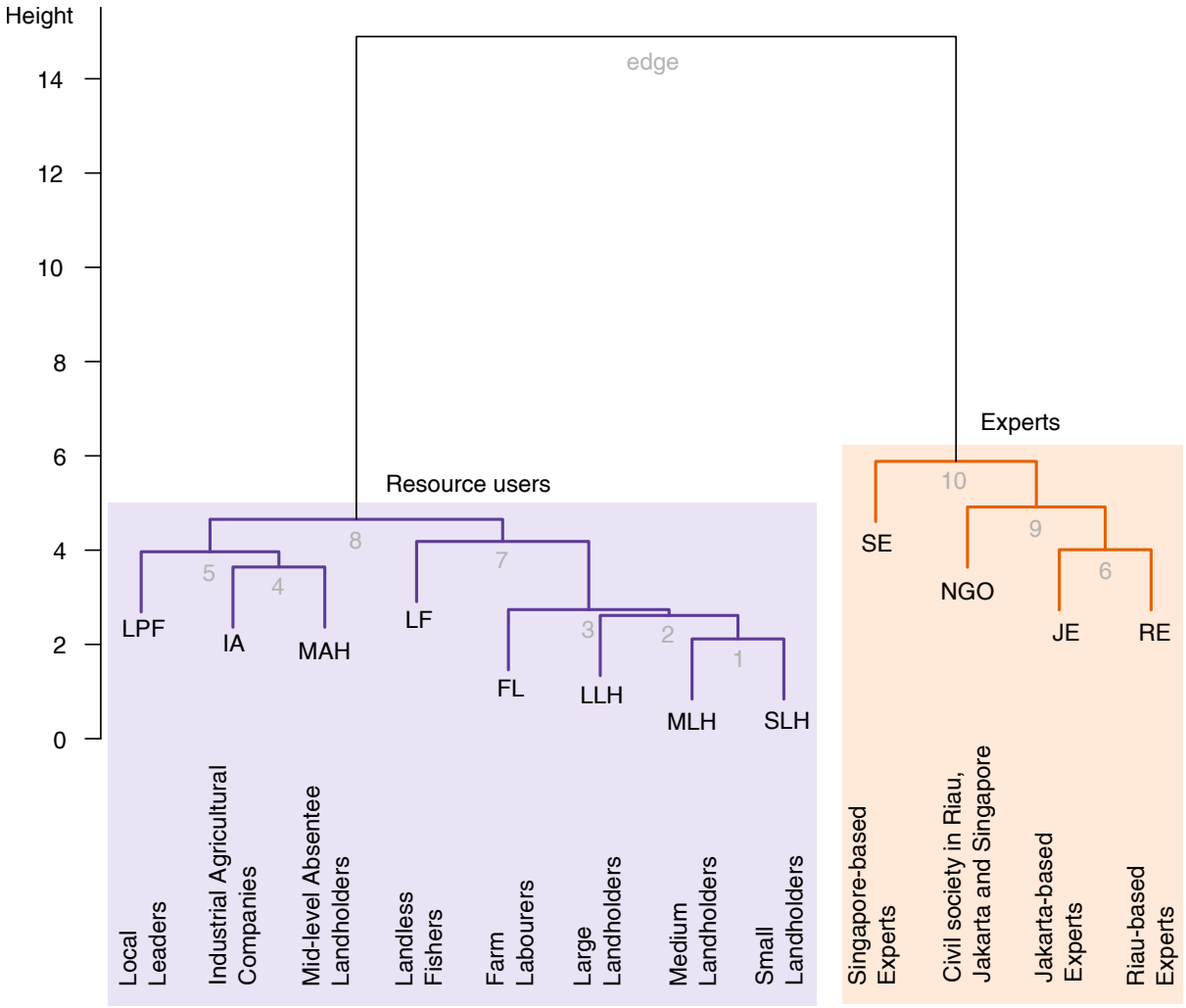

Figure 1: Cluster dendrogram of the average values of Q-sorts by stakeholder category. Connections between categories are represented in grey numbers and presented in order of similarity. For example, connection no. 1 (MLH with SLH) shows the two categories with the most similar perceptions and connection no. 10 (SE with the other experts) indicates the category with the most differentiated views.

Based on the shared features of categories within each group, we recognised that the main distinction between the two groups aligned with a dichotomy between ‘resource users’ versus

'experts' (Fig. 1 top and bottom clusters respectively). Although respondents can play different roles, through the analysis we determined these labels best described the difference in membership of these two groups that emerged from the analysis. The experts group was constituted of stakeholder categories with different types of technical expertise across geographic scales (civil society, government advisors, scientists and technical journalists in Singapore, Jakarta and Riau) and with comparatively fewer direct professional and personal links to the landscapes where fires occur. In contrast, the resource-users group included all local-level, farmer and land holding categories, most of whom reside in Riau Province and have direct links to land affected by fire.

Perspectives among stakeholder categories within the experts group were quite similar (relatively high correlations in Figure A2), particularly RE, JE and NGOs (Spearman's correlation coefficient $\rho > 0.6$). SE is slightly different from this trio ($\rho = 0.3–0.6$) but is still much more different to any category within the resource users ($\rho < 0.3$, except 0.4 with IA). Resource users presented more similar views ($\rho > 0.5$ in Figure A2).

The most considerable differences were between the two groups, but there was still some heterogeneity among categories within the groups. For example, categories in the resource-user group were separated into two distinct sub-groups and one isolated case: the industrial agriculture, local leaders and mid-level absentee landholder categories grouped together (LPF, IA, MAH). These were resource users who tended to own larger extents of land, and who may not have lived directly on their land holdings (Jelsma et al., 2017). In contrast, small, medium and large landholders and farm labourers grouped together (SLH, MLH, LLH, FL). Landless fishers (FL) did not align with any of these two sub-groups.

To understand why resource users and experts differed in their views (Fig. 1), we estimated the aggregated perspective within each group, regarding the perceived effectiveness of the 40

policy options (Fig 2). The greatest differences related to interventions to develop new shallow canals to mitigate fires (S16, both as a water source for fire fighting and to limit the excessive peatland drying associated with deep canals), which resource users considered as the most effective measure, while experts identified it as the fourth least effective option (Fig. 2). Instead, technical experts perceived stopping agricultural expansion on peatlands (S39) as highly effective, but resource users put this option in the least-effective quarter of all policy options. Other clear differences, where the two groups had markedly opposite perspectives, related to interventions to improve bank-lending policies for the agricultural sector (S31), raise awareness about the danger of cooking fires (S37) and clarify land tenure (S40).

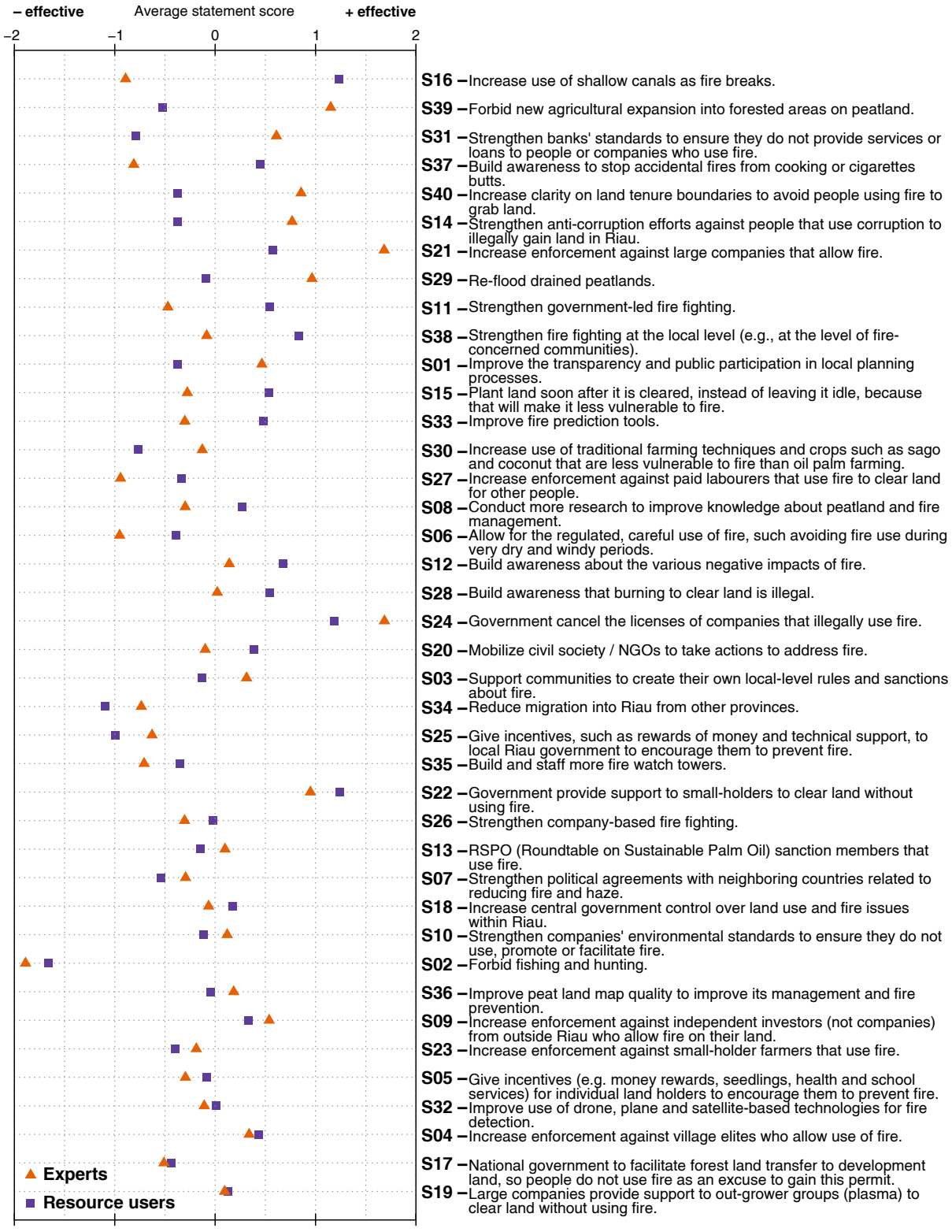

Figure 2: Effectiveness scores of 40 policy options according to experts and resource users. Data points represent the average score given by all respondents within each group, to each policy option (statements on the right also identified by a number). Policy options are ranked from most controversial (highest difference in scores between groups; top) to most consensus (bottom).

There were similarities between the two groups, indicated by the position of options in the lower half of Fig 2. Yet most of this consensus between the two groups related to neutral solutions that were perceived as neither effective nor ineffective. Both groups generally shared perspectives about the effectiveness of options such as retracting the permits of companies that illegally use fire (S24)—albeit with distinct emphasis relative to other options—and providing state support for small-scale land users to prepare agricultural land without using fire (S22). There were several options that both groups considered ineffective, notably bans on hunting and fishing in order to reduce associated fire setting (S02), providing incentives and technical support to local governments for fire mitigation (S25), and restricting regional migration to avoid greater land clearance through fire for agriculture (S34).

4. Discussion

We provide empirical evidence that supports a commonly-held assumption: experts and resource users have contrasting views over many policy options, despite alsosharing several notable points of common ground. In the case of policy responses to peatland fires in Indonesia, stakeholder categories held different perspectives and by looking at similarities among categories, perspectives firmly split into experts versus resource users. We interpret the differences and commonalities between these two groups, identify key patterns, and discuss plausible explanations.

Split between centralised and transformative *versus* localised and "business-as-usual" policy options

The split between experts and resource users reflected profoundly different approaches to fire mitigation and associated development pathways. The experts focused on the need for

centralised, large-scale, regulation-based interventions that seek to transform the governance of land and agricultural resources (e.g., clarifying land tenure, banning agricultural expansion, or further regulating bank loans), arguably representing an idealised best-case scenario. The resource users focused more on localised, non-regulatory, but tangible policy options that were largely compatible with existing agricultural practices for commodity crops (oil palm, timber for pulp and paper). This split likely reflected differences in perceptions of both the policy options and the underlying causes of fire.

For example, resource users considered effective policies to expand the use of shallow canals (S16, Fig. 2) to increase water retention in peat areas and water availability for firefighting. Farmers of different sized land holdings already routinely construct canals to drain the peat soil in preparation for cultivation (albeit often deeper than is legally allowed), and so may perceive the measure as compatible with existing practices and congruent with ongoing use and development. Similarly, they perceived policies to increase public awareness of the risks of using campfires to be effective (S37). This policy option attributes fire ignition to campfires lit during fishing trips, rather than to plantation agriculture (the region's core industry and many respondents' livelihood), again favouring existing practices. These policy options, while highly ranked among resource users, challenge little the status-quo for agriculture and are comparatively "soft" policy options with lower responsibilities and costs for resource users. Moreover, they accommodate existing practices by the palm oil industry's powerful vested interests associated with continued agriculture on fire-prone peatlands.

In contrast, experts had strongly opposite views about the effectiveness of both measures (S16, S37). The difference might be explained by a range of reasons, but the best explanation seems to be that experts perceived these measures as unlikely to challenge the status quo in agriculture. Shallow canals would still allow agricultural expansion, and focusing on

recreational fires as a source of peatland fires diverts attention from land management ignition sources; both measures may have been perceived as overlooking the underlying sustainability issue facing agriculture on peatland in the long term (cf. Wijedasa et al., 2016). These are also comparatively localised and decentralised measures, and experts may have considered them less reliable and small-scale than more centrally-enacted measures, such as regulatory bans (S39) or loaning requirements/standards (S31).

Instead, experts ranked as very effective policy options that would bring profound changes to the agricultural sector and land governance, and which would be driven relatively centrally through regulatory action. These measures addressed underlying drivers, tackling corruption (S14), reforming land tenure (S40), banning further agricultural expansion (S39) and changing loan conditions for agribusinesses (S31). All of these options involved regulatory, more transformative and large-scale changes, particularly when compared with measures ranked most effective by resource users. As such, they could profoundly disrupt many resources users' vested interests, not only those associated with industrial agriculture and elites, but also the economic opportunities palm oil has provided for millions of Indonesian farmers (see Santika et al. 2019). For example, clarifying land tenure over Indonesia's contested peatland areas could improve governance through clearer fire attribution (Gaveau et al., 2017, Toumbourou, 2018) but disrupt some existing practices of land-acquisition and speculation that have become central parts of Indonesian agriculture and land-grabbing (Li, 2018, McCarthy et al., 2012). Such practices have been particularly influential on peatland frontiers (Goldstein, 2015), with more than half of Riau's oil palm plantations reportedly planted illegally (Anggor, 2014). Changes to bank borrowing standards refer to loans for large actors, and could help mainstream sustainability practices across large parts of the sector (Pacheco et al., 2018). However, these changes could also restrict borrowing, hinder a

sector that is the primary driver of growth in the region, and challenge existing forms of financial power.

The policy options ranked as highly effective by experts were also characterised by their comparatively top-down, centrally-coordinated approach to regulating the agricultural sector. Unlike policy options such as building shallow canals and raising awareness about recreational fires, the options preferred by experts would more likely require active involvement of the national government, in the form of regulatory approaches and large-scale interventions. These reflect traditional forms of top-down hierarchical power (see Morrison et al. 2017) that they may consider desirable in the context of a comparatively unregulated frontier agriculture. Instead, many resource users may have considered these types of measures ineffective (and potentially undesirable), due to frustration over failed implementation of existing large-scale policies, or trust undermined by perceptions of corruption, oligarchy and paternalism (e.g., Barr and Sayer 2012, Purnomo et al., 2017, Varkkey, 2015). Dissatisfaction with government-led fire mitigation and resource governance may also increase concern over the effectiveness of centralised, top-down initiatives. For example, one of the most ambitious government-led programmes to clarify tenure (the *One Map Policy*, MacDonald, 2017) has evolved very slowly. In addition, the "Rewetting, Revegetation, Revitalization" peat restoration approach initiated and led by the Indonesian Peat Restoration Agency faced various obstacles such as annual fires, peat drought, land conversion, and lack of alternative livelihoods (Harrison et al., 2020).

Divergences connected to feasibility and cost perceptions

Importantly, responses about policy options' effectiveness were likely also informed by respondents' sense of what is possible, both for individuals and for institutions. This includes considerations of plausibility, familiarity with the different options, awareness of path dependencies, sense of power or influence, and the distribution of benefits and burdens associated with different policy options.

For example, plausibility depends on factors such as technical feasibility, economic cost, social acceptability, power dynamics, and alternatives available outside of the status quo. Some policy options, such as reflooding peatlands (S29), have already faced significant implementation challenges despite huge buy-in from government and donors, including because they disrupt existing livelihoods (Giesen and Nirmala 2018). Similarly, a series of previous moratoria on agriculture in peatlands (S39) have struggled with reporting, zoning which sites are included and producing tangible reductions in deforestation, including because they challenge existing practices and interests (e.g., Busch et al., 2015, EIA, 2019).

Divergent viewpoints may also be driven by different levels of familiarity and access to information. Experts may be accessing information from within comparatively narrow professional and knowledge networks that prefer—and echo—certain types of knowledge and policy options (Moeliono et al., 2014). The strong concurrence in perspectives among experts in our results suggest these phenomena. The options ranked highly by resource users were also more tangible and immediately visible to stakeholders operating on-the-ground, hence making these options more familiar to them. Conversely for some resource users the links between bank loan standards for agricultural companies/investors and fires (S31) may be less obvious or seemingly relevant.

Importantly, visions of policy options that lead to non-fire outcomes are also shaped by a broader sense of path dependency derived from specific types of livelihoods and production systems that rely on fire use (Meijaard and Sheil, 2019). Oil palm production on drained peatland is potentially the only apparent “rational choice” for some stakeholders and economically benefits many different parts of society (Purnomo et al. 2017). This path dependency likely extends to favour continuing with habitual practices, which is often considered a strong behavioural driver (i.e. status quo bias, Samuelson and Zeckhauser, 1988). Lock in may also be caused by the economic importance of palm oil nationally and in Riau, where the production model involving fire to clear land is important for a wide range of resource users, and there are few clear alternatives for farming and investment (Feintreinie et al. 2020, Jelsma et al., 2017, Purnomo et al., 2017).

The costs of many of these policy options are borne by resource users, including the active costs associated with implementing certain options (e.g., building canals or fire towers), and also a wide range of passive costs related to changes in livelihoods and foregone opportunities (e.g., reducing agricultural expansion, cf. Balmford and Whitten, 2003). Many of the options favoured by experts have profound implications for resource users—both positive and negative: the crops they can grow, the biophysics of their local environment, the finance they can access, the revenue they can generate, the ways they can access and use land, and entrenched patterns of privilege and power. Subject to these implications, it could be expected that resource users highlight policy options that allow them to continue business-as-usual and thereby incur lower costs. Further, they are likely reluctant to assume what they may perceive as disproportionate and unjust levels of responsibility. As explained in the methods, despite us asking respondents to rate effectiveness of policy options, responses likely reflected preferences too.

Divergences between the two groups could also be associated with differences in their scale of operation and the importance they gave to collective regional and global benefits of fire mitigation, versus the individual or local-level costs it entails (Balmford and Whitten, 2003). Similar rationales for divergences between farmers and scientists were found in earlier work (Baginetas, 2008). For example, certain experts may think predominantly of the societal benefits of a measure (albeit in an abstract way), whereas resource users may immediately think of the private costs of a policy option. Divergences likely also are related to respondents' different lived experiences, whereby experts evaluated policy options from so-called desk-based positions and other stakeholders were more deeply embedded within the realities of land and fire management (cf. Carmenta et al., 2013).

The two groups may have further differed in their underlying ideology, development aspirations, or even the mental models through which they understand not only policy options but also underlying drivers of fire (Adams et al., 2004, Biggs et al., 2011, Denzau and North, 1994). This is evident in the more granular differences in perspectives about the 40 policy options, as well as in the overall expert–resource user split in approaches to fire policies. This understanding is shaped by factors such as knowledge domains, experiences, and the scales at which stakeholders operate (e.g., Mansourian et al., 2020). It likely also reflects differentiated perceptions of the problem itself, including whether fire is perceived as a risk or a potential (possibly necessary) tool. Indeed, different positing of the initial problem could explain differences in perception of the solutions, with one group looking to mitigate the impacts of fire (e.g., through local firefighting interventions, S16), and the other looking to end fire use altogether (e.g., S34).

Overcoming the split

In the context of recurrent fires, there is a widespread sense of urgency to identify effective policy options. This effort often depends on implicit, subjective assumptions about who is right. Our results highlight the scale of this challenge, uncovering the magnitude of the disagreement about specific points and about overall approaches to fire policy. Improved sustainability relies heavily on negotiating these differences.

A common recommendation in Q studies for addressing conflicting views and easing negotiation is to focus on the areas of consensus because these offer potential entry points to contentious and challenging issues (options at the bottom of Fig. 2, Carmenta et al. 2017). Notably, three policy options stood out in our results as being considered effective by both groups. These are notable in the context of the many divergences we documented, especially considering the diversity of respondents and that many of those in the experts group were in positions likely to focus on more "centralized" regulatory policies as more effective policy options. Two of these policy options demonstrate high consensus, with one focused on sanctions targeted to large companies with license cancellations for using fire (S24), and the other focused on providing support to small scale farmers to manage land without fire (S22). A third option generated joint endorsement, but with differentiated emphasis between the groups: increasing enforcement against large companies that use fire (S21, top quarter in Fig. 2). Policy options such as increasing enforcement and cancelling corporate licenses have proved controversial in the past, arguably due to the implications of these measures for some actors and despite the consensus over the latter in these results. Notably, such options challenge powerful interests and can be hard to operationalise due to matters such as loopholes, corruption and enforcement gaps (e.g., Jong 2019, Normile 2019).

Negotiation requires balancing technically-robust interventions with considerations of feasibility, stakeholder preferences and a range of social equity, political and economic dimensions. Few of the policy options in this study have been fully or widely implemented, fewer have been evaluated for impact, and even fewer have been comparatively evaluated against alternatives. Moreover, to date many proposals that have appeared technically and theoretically robust have struggled at the implementation phase (e.g., moratoria on peatland expansion, bans on fire, *One Map Initiative* to clarify tenure, improved fire fighting, use of satellite technology, and the development of peat wetting infrastructure by the Indonesian Peat Restoration Agency). Therefore, while experts undoubtedly hold expertise, they may not have an equally strong understanding of the practicality of solutions, including whether they will recruit widespread engagement among resource users. There is thus a need to consider the different types of authority afforded to different types of knowledge held by stakeholders (see Vraga et al., 2018), and also to their differing responsibilities and capabilities, as well as their biases regarding individual preferences, which may affect their appraisal of policy options, as indicated in Methods.

A frequent recommendation is that experts should meaningfully engage with resource users and policy makers to co-produce knowledge and decisions (e.g., Edelenbos et al., 2011, Toumbourou 2018). Participatory processes are often challenging and potentially expensive and lengthy, but they can create interaction spaces to share interests, tackle value conflicts and navigate complex relations between stakeholders (cf. Biggs et al., 2017, Toomey et al., 2016). To facilitate these processes, mapping and comparing stakeholder perspectives can be useful in explaining disjuncts, enabling cross-stakeholder dialogue (cf. Adams et al., 2003, Biggs et al., 2017), and serving as a boundary object for participatory engagement. In our case, we sought to do this through a stakeholder-centred analysis of Q methodology data. This approach provides a legible map of perspectives and elevates diverse (and often

silenced) voices through affording equal weighting to all perspectives. Incorporating disenfranchised voices into the debate of politically complex problems can mitigate the negative outcomes derived from disagreements exacerbated by a range of power asymmetries (as explained in the introduction). Further, the distinction of opinions across stakeholder groups, the opinion-based 'alliances' among them and the areas where opinions coincide, can help navigate discussions about solutions toward a more constructive end, by taking into account each stakeholders' sensitivities regarding policy options.

Two fundamental assumptions underpin the usefulness of this perspective-mapping exercise: that appropriate fora, institutions and processes exist for brokering across divergent views; and that overcoming the perspective gap is desirable and possible. Participatory processes can be instrumentalized (co-opted) to enhance or legitimate elite's powers (Viana et al 2016)—including those of experts. Moreover, the specific goal of engaging experts, resource users and policy makers together is often unclear: Is it to better understand users' needs and, with this understanding, to design and propose improved policy options? Does improvement mean more sustainable, equitable or efficient? Or is the aim to bring resource users closer to the experts' point of view?

Concluding remarks: academic researchers as (detached?) experts

While we anticipated differences among stakeholder categories, we did not expect that the expert group would constitute such a distinctive cluster. Accordingly, this research also served the (unintended) effect of underscoring the disconnect that can exist between academic researchers' perspectives (the authors included) about fire policy options and those of resource users.

Academic researchers are part of the broader ‘experts’ group as defined here, whereas resource users include both individuals with great lobbying/ political power (such as industrial agriculturalists, local public figures) and respondents for whom academic researchers may have greatest concern (e.g., hired labour, landless farmers). As individuals whose experience is, for the most part, removed from the realities of land use management, academic researchers tend to promote more transformative policy options, but from the comfort of being comparatively distant from implementation challenges, trade-offs and burdens (i.e. ivory tower phenomenon).

This phenomenon demands a candid (realistic, pragmatic) reflection on academic contributions to policy debates. Scholars need to continually consider and adapt how to engage in these processes, including how to input our own perspectives, recognising our underlying preferences and the limits of our knowledge (see Dick et al., 2016, Meffe and Viederman, 1995), while also defending the role of diverse evidence, stakeholders and knowledges, in decision-making.

In particular, overcoming expert–citizen divides requires academic researchers to better solicit diverse views (such as with the approach in this study) and identify brokers (e.g., champions, bridging institutions, knowledge brokers) that can speak across such divides (Di Gregorio et al, 2019). Importantly, it requires processes that encourage the comprehension of diverse perspectives (e.g. Marlier et al, 2019), and acceptance of the added complexity and time this usually requires. For researchers, this means building technical competence and effective science communication that integrates and mediates among different stakeholder views and values (see Carlton and Jacobson 2016). However, it also requires pragmatism, empathy, and the ability to accept policy options that we might not prefer or perceive as most effective and to detach from those we perceived as best.

In our experience, this openness remains at odds with the way many scholars think about environmental challenges and policy making. Rather, our experience suggests the need for researchers to embrace the perspectives of other stakeholders as well as critically reflect on our own. This may require exploring methods for eliciting perspectives that allow for multiple values and nuance. Complementary qualitative work is likely needed beyond describing and quantifying splits in perspectives, to also uncover the complex motivations and narratives that help to explain these differences, including underlying assumptions, positionality relative to land use, and the costs and politics of policy options. Such directions can lead scholars to deeper empathy with others, including resource users. This is a paramount challenge: if no single view is capable of deciphering the “best” answer, then a number of disciplines, ideologies and ontologies are required to identify, debate and pursue the most acceptable fits. Overcoming these chasms requires interdisciplinary scholars that can speak across the divide, balancing technical, scientific and social arguments from a range of stakeholders.

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Appendix for "Experts and resource users split over solutions to peatland fires"

Contents:

Supplementary Methods

Data collection

Respondents in this study were selected using purposive sampling and identified through actor mapping. Actor mapping was informed by initial field scoping in Dumai, Riau over 6 weeks in early 2015, involving workshops attended by two of the authors, expert consultation (with donor, NGO, scientist representatives), and literature review (including journal publications and grey literature in Indonesian and English). This process yielded definition of a set of twelve broad stakeholder groups that captured the breadth of roles related to peatland management and fire.

Stakeholders included respondents from multiple spatial and governance scales and these were then sampled, including policy communities based in Pekanbaru (Riau), Jakarta and Singapore. Policy communities were broadly defined, and included civil servants, researchers (e.g. from universities and think tanks), CSOs and government representatives with an interest and a role in the policy arena of peatland fires. Within the stakeholder group categories, the respondents were selected to represent different viewpoints and backgrounds to ensure maximum diversity of possible perspectives. The large majority of respondents were at the farm level (e.g. small-scale farmers, landless residents, agro-industry, external investors) and included both men and women.

Site selection at the local level was achieved using spatial analysis of MODIS derived hotspots, Landsat imagery of land cover and available maps of land tenure types, to identify three sites with a diversity of land uses (rubber, acacia, oil palm and idle land), fire dynamics, land tenure arrangements and actors. Respondents were sampled from three locations in Dumai and Bengkalis in the northern part of Riau province.

Town-based and industrial agriculture interviewees were contacted prior to the interview to invite them to participate in the study. Community-based respondents were approached following a meeting with the village leader (*kepala desa*). In this meeting the research was introduced and questions about the project were addressed. If permission was granted, a member of the research team then selected households randomly for the interview. The research team in the field was led by one of the authors, supported with two research assistants from the University of Riau. In each interview, the researcher introduced the project to the potential respondent, engaged in a discussion about the motivation, process and outputs that might arise from the work and invited participation under the understanding that participation was optional, anonymous and that withdrawal at any time was possible.

All respondents were presented the same set of items. All items had an identifying image, and were written in either English or Bahasa depending on the main language of the respondent. All surveys were administered face-to-face, where all respondents ranked the same deck of statements printed on cards, over a board with a grid emulating a pyramid with a quasi-normal distribution, as standard in Q methodology.

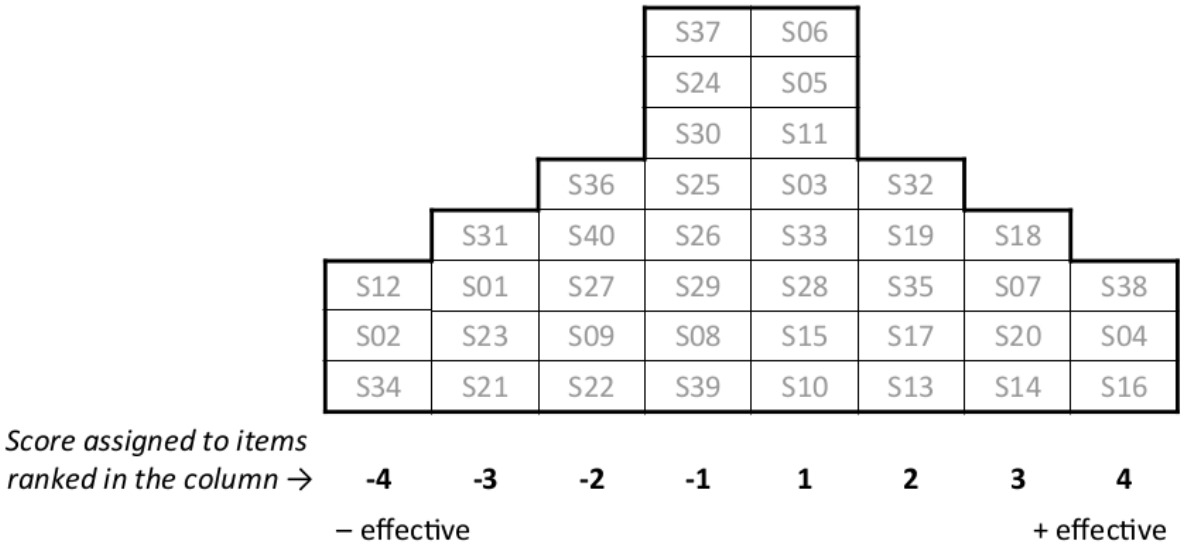

Figure A1: Grid for respondents to sort the items (policy options). Column scores and an example response are shown. In this example, the respondent placed statement S34 in the left-most column, and therefore that statement was assigned a score of -4 in the dataset, alongside S02 and S12.

Analysis

For the analysis of views by stakeholder groups, we estimated the representative response for each group using the mean response. This approach also provided clearer differences than running a separate PCA for each category and selecting the first component. Other options we considered included a principal components analysis for each category separately, and choosing the first factor (or component) as the category's most representative. For example, Cuppen et al. (2010) compare a range of stakeholder categories by identifying perspectives using the standard analysis and calculating the mean factor loading of each category of

respondents for each perspective. To explore what sort of options policymakers consider, Ockwell (2008) assessed the fraction of government officials that each perspective represented (i.e. in which perspective government officials' Q-sorts were flagged). These approaches focus on disaggregating perspective diversity across the whole sample, and then explore which stakeholders are associated with these different perspectives, ex post to the main analysis. In contrast, and unique among Q studies, we first disaggregated stakeholder categories, in order to then explore how perspectives differed across those categories.

After calculating the mean response by stakeholder category, we conducted a hierarchical cluster analysis to explore affinities among stakeholder categories (i.e. similarity in the perspective held by each category). We used Hierarchical clustering with Euclidean distance, Ward D method (*hclust* function from package *stats* in R, 2020, v. 3.6.3). As an additional robustness check, we built a correlation matrix of the perspectives, which further highlighted the degree of association between pairs of categories (see Annex). Finally, to understand how the resulting clusters thought differently about fire responses, we compared the aggregated perspective of the stakeholder categories within each cluster, calculating the mean response for each of the 40 policy options and visualising them in a z-score plot (*qmethod* package for R, Zabala, 2014).

Supplementary results

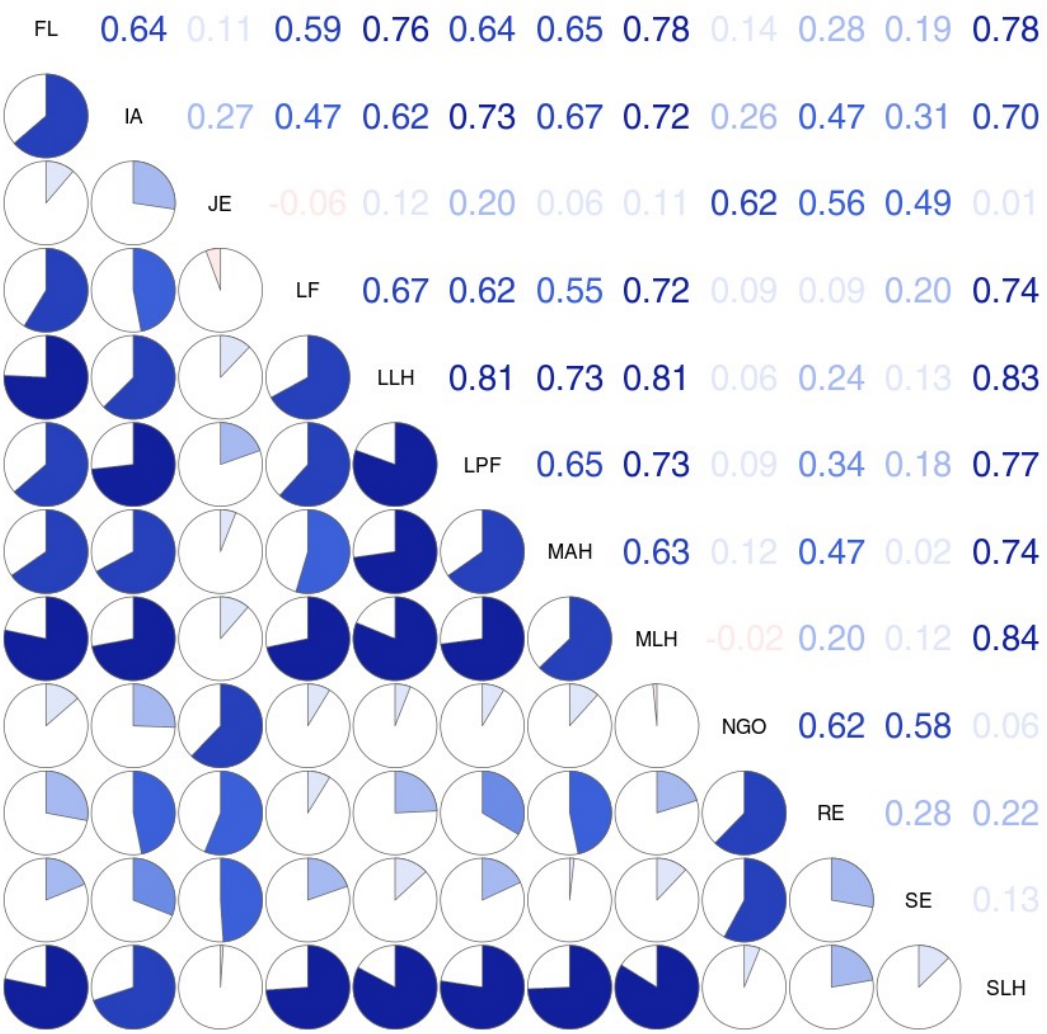

Figure A2: Correlation matrix of the average values of Q-sorts for solutions, by stakeholder group. Spearman correlation coefficients. Number size and colour intensity indicate the magnitude of the correlation coefficient.

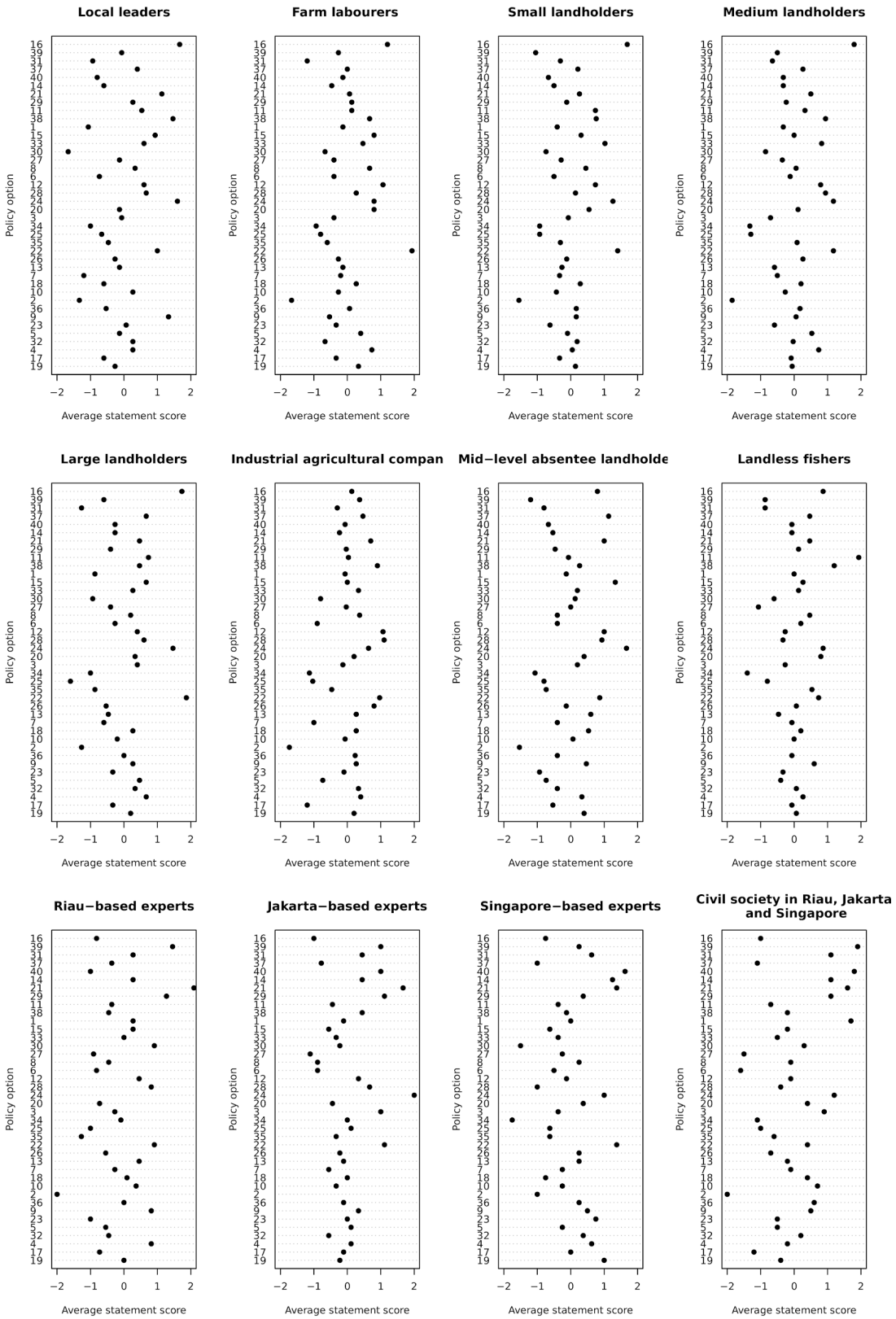

Figure A3: Mean responses by stakeholder category.

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